DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 30 June 2011 has been entered.

Response to Arguments

2. Applicant's arguments filed 30 June 2011 have been fully considered but they are not persuasive.

Applicant argues:

> The current invention has, however, surprisingly found that the use of a cathode formed of a mesoporous nickel, a nickel oxide, a nickel hydroxide, a nickel oxy-hydroxide or a combination of two or more of these with an aqueous electrolyte and an anode comprising mesoporous titanium dioxide or a mesoporous lithium titanate, produces an extremely advantageous electrochemical cell for use as a lithium-ion battery or a supercapacitor. None of the cited prior art documents discloses the unexpected advantages of such a cell.

However, unexpected, superior result can not be shown by a statement, evidentiary support must be provide to show unexpected, superior results.

Applicant further argues that Anderson teaches away from the use of titanium oxides as Anderson states that titanium oxides are less attractive than other

oxides investigated. The examiner notes Anderson discloses titanium dioxide may be less desirable than other oxides based on its low conductivity and that said conductivity can be improved via organic electrolytes, but Anderson never discloses that the titanium oxides will not be useable in an aqueous electrolyte or that titanium oxides will not be used at all. Furthermore the examiner notes that no where in the specification does Anderson disclose the use of titanium oxide will be detrimental to the device and therefore should not be used. The examiner further notes previously cited USPAT 6,275,371 which discloses an electrochemical capacitor comprising titanium oxide electrodes and alkaline aqueous electrolytes which would include LiOH. The examiner also notes USPGPUB 2001/0000484 which discloses titanium dioxide used with an aqueous electrolyte comprising LiOH. It is the contention of the examiner that one of ordinary skill in the art would consider using the mesoporous titanium dioxide taught by Sugnaux or the mesoporous lithium titanate taught by Spitler (see rejection below) as the anode of Anderson for the reasons stated below in the rejections.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

4. The factual inquiries set forth in *Graham* v. *John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

5. Claims 1, 3, 8, 11, 13-16, & 19-22 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson et al. (5,963,417) in view of Sugnaux et al. (2004/0131934).

In regards to claim 1,

Anderson ‘417 discloses an electrochemical cell comprising a cathode, an anode and an electrolyte, wherein: the electrolyte comprises an aqueous solution containing lithium and hydroxide ions; and the cathode is formed of a mesoporous material selected from the group consisting of nickel, a nickel oxide, a nickel hydroxide, a nickel oxy-hydroxide and combinations thereof (claim 1; C10:L42-63). Anderson '417 fails to explicitly disclose the anode comprises mesoporous titanium dioxide or a mesoporous lithium titanate.

Sugnaux ‘934 discloses an electrochemical cell comprising an anode comprising mesoporous titanium dioxide or a mesoporous lithium titanate ([0086]).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Sugnaux ‘934 as the anode of Anderson '417 to obtain an anode with a large surface area, improved thermal dissipation and mechanical strength, and obtain a device with a large capacity.

In regards to claim 3,

The references as applied above disclose all the limitations of claim 3 except the mesoporous titanium dioxide or lithium titanate has a periodic arrangement of substantially uniformly sized pores of cross-section of the order of 10^{-8} to 10^{-9} m.

Sugnaux ‘934 discloses the mesoporous titanium dioxide or lithium titanate has a periodic arrangement of substantially uniformly sized pores of cross-section of the order of 10^{-8} to 10^{-9} m ([0026]).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Sugnaux ‘934 as the anode of Anderson '417 to obtain an anode with a large surface area, improved thermal dissipation and mechanical strength, and obtain a device with a large capacity.

In regards to claim 8,

The references as applied above disclose all the limitations of claim 8 except the mesoporous structure of the cathode and/or anode has a pore diameter within the range from 1 to 10 nm. However, Anderson '417 further discloses the mesoporous structure of the cathode and/or anode has a pore diameter within the range from 1 to 10 nm (C10:L59-60).

In regards to claim 11,

The references as applied above disclose all the limitations of claim 11 except in which the mesoporous structure of the cathode and/or anode has a hexagonal arrangement of pores that are continuous through the thickness of the electrode.

Sugnaux '934 discloses in which the mesoporous structure of the cathode and/or anode has a hexagonal arrangement of pores that are continuous through the thickness of the electrode ([0051]).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Sugnaux '934 as the anode of Anderson '417 to obtain an anode with a large surface area, improved thermal dissipation and mechanical strength, and obtain a device with a large capacity.

In regards to claim 13,

The references as applied above disclose all the limitations of claim 13 except the mesoporous structure of the cathode and/or anode is a film having a thickness in the range from 0.5 to 5 micrometers. However, Anderson ‘417 further discloses the mesoporous structure of the cathode and/or anode is a film having a thickness in the range from 0.5 to 5 micrometers (C9:L24-26).

In regards to claim 14,

The references as applied above disclose all the limitations of claim 14 except in which the mesoporous structure of the cathode and/or anode has a cubic arrangement of pores that are continuous through the thickness of the electrode.

Sugnaux ‘934 discloses the mesoporous structure of the cathode and/or anode has a cubic arrangement of pores that are continuous through the thickness of the electrode ([0051]).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Sugnaux ‘934 as the anode of Anderson '417 to obtain an anode with a large surface area, improved thermal dissipation and mechanical strength, and obtain a device with a large capacity.

In regards to claim 15,

The references as applied above disclose all the limitations of claim 15 except the titanium dioxide or lithium titanate is nanoparticulate.

Sugnaux ‘934 discloses the titanium dioxide or lithium titanate is nanoparticulate ([0051]).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Sugnaux ‘934 as the anode of Anderson '417 to obtain an anode with a large surface area, improved thermal dissipation and mechanical strength, and obtain a device with a large capacity.

In regards to claim 16,
The references as applied above disclose all the limitations of claim 16 except the anode comprises titanium dioxide.

Sugnaux ‘934 discloses the anode comprises titanium dioxide ([0086]).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Sugnaux ‘934 as the anode of Anderson '417 to obtain an anode with a large surface area, improved thermal dissipation and mechanical strength, and obtain a device with a large capacity.

In regards to claim 19,

The references as applied above disclose all the limitations of claim 19 except the electrolyte comprises an aqueous solution of lithium hydroxide. However, Anderson ‘417 further discloses the electrolyte comprises an aqueous solution of lithium hydroxide (C10:L242-43).

In regards to claim 20,

The references as applied above disclose all the limitations of claim 20 except is a battery.

Sugnaux ‘934 discloses is a battery ([0060]).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form a battery as taught by Sugnaux '934 when forming the device of Anderson '417 to obtain a high power battery that can be used to power electronic devices.

In regards to claim 21,

The references as applied above disclose all the limitations of claim 21 except is a supercapacitor. However, Anderson ‘417 further discloses is a supercapacitor (title).

In regards to claim 22,

The references as applied above disclose all the limitations of claim 22 except the mesoporous structure of the cathode and/or anode has a pore diameter within the range from 2.0 to 8.0 nm. However, Anderson '417 further discloses the mesoporous structure of the cathode and/or anode has a pore diameter within the range from 2.0 to 8.0 nm (C10:L59-60).

6. Claims 1, 3, 8-14, 16, 19-20, & 22-25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Lv (2001/0000484) in view of WO99/00536 hereafter referred to as Bartlett.

In regards to claim 1,

Lv '484 discloses an electrochemical cell comprising a cathode, an anode and an electrolyte, wherein: the anode comprises titanium dioxide or a mesoporous lithium titanate; the electrolyte comprises an aqueous solution containing lithium and hydroxide ions; and the cathode is formed of a material selected from the group consisting of nickel, a nickel oxide, a nickel hydroxide, a nickel oxy-hydroxide and combinations thereof ([0044-0046]). Lv. 484 fails to disclose the cathode and anode formed of mesoporous material.

Bartlett discloses an electrochemical cell comprising electrodes formed of mesoporous material (page 15: line 28 to page 16:line14 & Page 10: lines 24-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 3,

The references as applied above disclose all the limitations of claim 3 except the mesoporous titanium dioxide or lithium titanate has a periodic arrangement of substantially uniformly sized pores of cross-section of the order of 10^{-8} to 10^{-9} m.

Bartlett discloses the mesoporous titanium dioxide or lithium titanate has a periodic arrangement of substantially uniformly sized pores of cross-section of the order of 10^{-8} to 10^{-9} m (page 10: lines 20-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 8,

The references as applied above disclose all the limitations of claim 8 except the mesoporous structure of the cathode and/or anode has a pore diameter within the range from 1 to 10 nm.

Bartlett discloses the mesoporous structure of the cathode and/or anode has a pore diameter within the range from 1 to 10 nm (page 10: lines 20-26).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 9,

The references as applied above disclose all the limitations of claim 9 except the mesoporous structure of the cathode and/or anode has a pore number density of from $4x10^{11}$ to $3x10^{13}$ pores per cm^2.

Bartlett discloses the mesoporous structure of the cathode and/or anode has a pore number density of from $4x10^{11}$ to $3x10^{13}$ pores per cm^2 (page 10: lines 28-30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 10,
The references as applied above disclose all the limitations of claim 10 except at least 85% of the pores in the mesoporous structure of the cathode and/or anode have pore diameters to within 30% of the average pore diameter.

Bartlett discloses at least 85% of the pores in the mesoporous structure of the cathode and/or anode have pore diameters to within 30% of the average pore diameter (page 11: lines 1-4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical,

electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 11,

The references as applied above disclose all the limitations of claim 11 except the mesoporous structure of the cathode and/or anode has a hexagonal arrangement of pores that are continuous through the thickness of the electrode.

Bartlett discloses the mesoporous structure of the cathode and/or anode has a hexagonal arrangement of pores that are continuous through the thickness of the electrode (page 11: lines 23-30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv ‘484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 12,

The references as applied above disclose all the limitations of claim 12 except the hexagonal arrangement of pores has a pore periodicity of in the range from 5 to 9 nm.

Bartlett discloses the hexagonal arrangement of pores has a pore periodicity of in the range from 5 to 9 nm (page 11: lines 23-30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 13,
The references as applied above disclose all the limitations of claim 13 except the mesoporous structure of the cathode and/or anode is a film having a thickness in the range from 0.5 to 5 micrometers.

Bartlett discloses the mesoporous structure of the cathode and/or anode is a film having a thickness in the range from 0.5 to 5 micrometers (page 9: lines 5-7).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical,

electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 14,

The references as applied above disclose all the limitations of claim 14 except the mesoporous structure of the cathode and/or anode has a cubic arrangement of pores that are continuous through the thickness of the electrode.

Bartlett discloses the mesoporous structure of the cathode and/or anode has a cubic arrangement of pores that are continuous through the thickness of the electrode (page 12: lines 1-8).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv ‘484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 16,

The references as applied above disclose all the limitations of claim 16 except the anode comprises titanium dioxide. However, Lv ‘484 further discloses the anode comprises titanium dioxide ([0044]).

In regards to claim 19,

The references as applied above disclose all the limitations of claim 19 except the electrolyte comprises an aqueous solution of lithium hydroxide. However, Lv '484 further discloses the electrolyte comprises an aqueous solution of lithium hydroxide [0046]).

In regards to claim 20,

The references as applied above disclose all the limitations of claim 20 except is a battery. However, Lv '484 further discloses is a battery (title).

In regards to claim 22,

The references as applied above disclose all the limitations of claim 22 except the mesoporous structure of the cathode and/or anode has a pore diameter within the range from 2.0 to 8.0 nm.

Bartlett discloses the mesoporous structure of the cathode and/or anode has a pore diameter within the range from 2.0 to 8.0 nm (page 10: lines 24-27).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical,

electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 23,

The references as applied above disclose all the limitations of claim 23 except the mesoporous structure of the cathode and/or anode has a pore number density of from $1x10^{12}$ to $1x10^{13}$ pores per cm^2.

Bartlett discloses the mesoporous structure of the cathode and/or anode has a pore number density of from $1x10^{12}$ to $1x10^{13}$ pores per cm^2 (page 10: lines 28-30).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv '484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 24,

The references as applied above disclose all the limitations of claim 24 except at least 85% of the pores in the mesoporous structure of the cathode and/or anode have pore diameters to within 10% of the average pore diameter.

Bartlett discloses at least 85% of the pores in the mesoporous structure of the cathode and/or anode have pore diameters to within 10% of the average pore diameter (page 11: lines 1-4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv ‘484 using the method of Bartlett to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

In regards to claim 25,
The references as applied above disclose all the limitations of claim 25 except at least 85% of the pores in the mesoporous structure of the cathode and/or anode have pore diameters to within 5% of the average pore diameter.

Bartlett discloses at least 85% of the pores in the mesoporous structure of the cathode and/or anode have pore diameters to within 5% of the average pore diameter (page 11: lines 1-4).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to form the electrodes of Lv ‘484 using the method of Bartlett

to obtain mesoporous electrodes with large surface areas, improved mechanical, electrochemical, chemical, thermal durability, and low effective series resistance to electrolyte diffusion.

7. Claims 1 & 17-18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Anderson ‘417 in view of Spitler et al. (2004/0197657).

In regards to claim 1,

Anderson ‘417 discloses an electrochemical cell comprising a cathode, an anode and an electrolyte, wherein: the electrolyte comprises an aqueous solution containing lithium and hydroxide ions; and the cathode is formed of a mesoporous material selected from the group consisting of nickel, a nickel oxide, a nickel hydroxide, a nickel oxy-hydroxide and combinations thereof (claim 1; C10:L42-63). Anderson '417 fails to explicitly disclose the anode comprises mesoporous titanium dioxide or a mesoporous lithium titanate.

Spitler ‘657 discloses an electrochemical cell comprising an anode comprising mesoporous titanium dioxide or a mesoporous lithium titanate ([0022] & abstract).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Spitler ‘657 as the anode of

Anderson '417 to obtain an electrochemical device with high charge and discharge rates and a high number of charge, discharge cycles.

In regards to claim 17,

The references as applied above disclose all the limitations of claim 17 except the anode comprises a lithium titanate.

Spitler '657 discloses the anode comprises a lithium titanate (abstract).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Spitler '657 as the anode of Anderson '417 to obtain an electrochemical device with high charge and discharge rates and a high number of charge, discharge cycles.

In regards to claim 18,

The references as applied above disclose all the limitations of claim 18 except the lithium titanate is $Li_4Ti_5O_{12}$.

Spitler '657 discloses the lithium titanate is $Li_4Ti_5O_{12}$ (abstract).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the anode taught by Spitler '657 as the anode of

Anderson '417 to obtain an electrochemical device with high charge and discharge rates and a high number of charge, discharge cycles.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

USPGPUB 2004/0265689

USPAT 6,503,382

Communication

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DAVID M. SINCLAIR whose telephone number is (571)270-5068. The examiner can normally be reached on Mon - Thurs. 8-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, JAYPRAKASH N. GANDHI can be reached on (571) 272-3740. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/DAVID M SINCLAIR/
Examiner, Art Unit 2835